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NEW HAVEN, CONN.

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Inspection and Care of Nursery Stock.

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NOTICE AS TO BULLETINS.

The Bulletins of this Station are mailed free to citizens of Connecticut who apply for them, and to others as far as the limited editions permit.

Applications should be renewed annually before January 1st.

The matter of all the Bulletins of this Station, in so far as it is new or of permanent value, will be made part of the Annual Report of the Station Staff.

All Bulletins earlier than No. 71 and Nos. 72, 83, 86, 93, 100, 101, 102, 111 and 118 are exhausted and cannot be supplied.

NOTICE AS TO SUPPLY OF STATION REPORTS.

The Station has no supply of its Annual Reports for the years 1877, 1878, 1879, 1880, 1881, 1882, 1883, 1887 and 1891.

The Annual Report of this Station, printed at State expense, is by law limited to an edition of 7,000 copies.

After exchanging with other Experiment Stations and Agricultural Journals, the Reports remaining at the disposal of the Station will be sent to citizens of Connecticut who shall seasonably apply for them, and to others as long as the supply lasts.

FORMER REPORTS WANTED.

There is frequent call for our earlier Annual Reports on the part of public libraries, students, chemists, naturalists, and station workers.

Persons who can supply copies of Reports for any of the years above named, will be likely to find purchasers by communicating with the Director.

INSPECTION AND CARE OF NURSERY STOCK.

By W. E. BRITTON.

Legislation.—In fifteen States, laws have been enacted providing for the inspection of nursery stock and in some cases of orchard trees as well. The object of this inspection is to find out whether or not certain noxious insects and fungi are present which threaten the fruit-growing interests of the whole State and to prevent their spread by the sale of infected nursery stock. At this writing similar measures are awaiting legislative action in five other States. Connecticut, as yet, has no such inspection laws.

This legislation has been mostly occasioned by the San José scale, a pest which can be extirpated by prompt treatment and which if permitted to live will surely destroy not only our fruit orchards but also many ornamental trees and shrubs.

The San José scale has been distributed chiefly by means of nursery stock. The inspection laws of different States vary considerably in their requirements, causing much annoyance to nurserymen desiring to ship stock into these States.

The Scale in Connecticut.—The San José scale has been found in over twenty towns of this State, some of them containing several distinct infested localities and mostly situated along the coast. The central portion of the State as far north as Hartford has also been invaded, and probably there are other infested areas not yet brought to our knowledge.

Nursery Inspection in Connecticut.—Since the laws of neighboring States debar Connecticut nurserymen from shipping nursery stock into such States unless accompanied by a certificate of inspection, this Station has deputed a member of its staff to inspect nurseries upon application of the owners and to give certificates, in case no scale or other pests of a serious nature are found. Early in 1899 regulations were formally adopted by the Station Board of Control regarding such inspection and the granting of certificates. The following circular embodies these rules and has been already mailed to about seventy nurserymen, seedsmen, and plant dealers.

THE CONNECTICUT AGRICULTURAL EXPERIMENT STATION.

NEW HAVEN, CONN.

NOTICE TO CONNECTICUT NURSERYMEN.

Some States, to which Connecticut nurserymen frequently ship nursery stock, have laws designed to prevent the further dissemination of certain insect and fungous pests, by requiring that all stock brought into these States, shall come from inspected nurseries in which none of these diseases have been found, and that a copy of the inspection certificate shall accompany each shipment.

In answer to requests from nurserymen, this Station has made inspections, and has given certificates when the stock was not found infested or diseased.

The following information is given for the benefit of those who may hereafter apply:

1. One of the Station staff, competent to do the work, will inspect any nursery in the State upon the written application of the owner; there will be no charge for the services of the inspector, but his traveling and incidental expenses are to be paid by the nurseryman.

2. If no indications of San José Scale or other serious insect pest, or of dangerous infectious diseases are found, a certificate to that effect will be given.

If any one of these dangerous insect pests or diseases is found, no certificate will be given.

3. The certificate will be in the following form:

*"This is to Certify, That on
189.... the undersigned inspected the stock in the nursery of
..... of
Conn., and found no evidence of the presence of San José Scale,
or other dangerously injurious insect or fungous pests, liable to be
introduced into orchards, upon nursery stock."*

This form of certificate may be modified by the Station if considered desirable.

4. Whether scale or dangerous diseases are found or not, the nursery will not be again inspected until after one growing season has passed.

5. Upon evidence of the fraudulent use or abuse of certificates by any nurseryman, the Station may refuse to make inspections for him in the future.

6. When stock is known to be infested, nurserymen must take vigorous measures to eradicate the trouble from it. The Station will give advice as to the best methods of procedure. Where such measures are promptly taken by the owner of the nursery, the Station will not ordinarily make known the names of nursery firms having infested stock. The Station, however, reserves the right to publish this information, and will do so when the safety and welfare of the public seem to demand it.

Nursery Practices.—As nurserymen and tree dealers generally buy more or less of their stock from various localities, it is not improbable that most of them at some time have thus brought the scale into their nurseries. Whether the insect has remained there and developed or not has depended largely upon their business methods. One object of this bulletin is to call attention to the fact that certain practices are favorable to the development and increase of the scale; and that if such practices are abandoned an infested nursery may more readily become clear of this pest. First of all the nurseryman should make himself familiar with the appearance and habits of the scale insect and should carefully watch his stock. Although much has been published about the insect, there are yet nurserymen who have never seen it and apparently have taken no trouble to inform themselves regarding it.

Experience shows that in a scale-infested nursery the insects are found most commonly and abundantly upon left-over stock which has been planted out and allowed to remain in nursery rows sometimes for three or four years. If any of this stock was even slightly infested when it was first received into the nursery, the insects have had time to multiply and become so numerous that they are easily detected by the inspector. Such stock is rarely of much value, and the nurseryman would do better to destroy it rather than let it remain as a breeding place for pests of all kinds. All unsaleable stock should be promptly destroyed by fire and the remainder fumigated or otherwise treated before planting out.

The official inspector, in examining nursery stock, will properly look over with the greatest care those trees which most commonly

are found infested, viz: apple, pear, plum and quince. The San José Scale will attack many other kinds of trees and shrubs.

Scales are not as likely to be disseminated on blackberry and raspberry stock as upon fruit trees because their tops are cut off and burned previous to shipping the plants. Peach stock is also less liable to become badly infested in the nursery on account of its rapid growth.

The proprietor or foreman who works continually amongst the trees, if he will take the trouble to acquaint himself with the scale, should be the best inspector. He has opportunity to examine the stock when it is received, when it is planted out, during all its growth, and finally when it is dug and prepared for shipment. The official inspector, in making his tour of the nursery, may overlook insects or fungi that would not fail to be detected if he had frequent occasion to traverse the ground.

Suggestions to Orchardists.—It is quite as important for the orchardist as for the nurseryman to treat his trees before planting out. The nurseryman should not be wholly blamed for the increase and spread of the scale. Many trees are planted each year only to be neglected, and if such trees are infested, all trees in the immediate vicinity soon become so. Trees can be treated much more effectively and economically before they are planted than afterwards. If it is not feasible for the fruit grower to fumigate them, they can easily be dipped, while bunched, into a solution of whale-oil soap. The tops should first be well pruned and if the soap solution is in a barrel or deep tank, a bunch of trees can be plunged into it, top first, as far as the roots. It is perhaps best not to dip the roots. This method has been practiced by at least one Connecticut fruit-grower. The expense of such treatment is very slight.

Value of Certificates.—The certificate states that an examination has been made and that certain insects and diseases have not been found. It does not, however, guarantee or imply that they are altogether absent. These pests are so difficult to detect, when present in small numbers on a few trees, that no person can so thoroughly examine a nursery of ordinary size as to be warranted in stating that it is absolutely free from them. If they are but moderately abundant in any portion of the nursery the inspector will readily find them. The value of a certificate, then, is to show that a careful inspection has been made by a competent person, and that the inspected nursery is reasonably free from dangerous diseases and pests.

TREATMENT.

There are three methods by which the San José scale may be destroyed with little trouble or expense, viz.: (1) Fumigating with hydrocyanic acid gas. (2) Spraying with kerosene and water. (3) Spraying with or dipping the trees in a solution of whale-oil soap.

For nursery stock, fumigation is probably the most efficient and cheapest treatment. It is attended, however, by more or less danger to the operator and should never be entrusted to careless employes.

Fumigation.—A tight box or house is necessary in which to enclose the stock. If the nursery is an extensive one it would probably pay to erect a house of two rooms for the purpose. The walls, roof and floor of such a house should be double boarded with heavy building paper between to make it gas-tight. A suitable number of doors should be arranged for convenience in filling and taking the trees from the house. Roof ventilators which can be opened and shut from the outside are a convenience. A house of this kind is inexpensive, and may be used as a storehouse when not needed for fumigating purposes. For a small nursery, however, a tight box large enough to take in fruit trees may be used to good advantage.

Prof. W. G. Johnson, of Maryland, who has had much experience in fumigating nursery and orchard trees, recommends* quantities of chemicals as follows for each 100 cubic feet of enclosed space :

25 grams (a little less than 1 oz.) (by weight) Potassium Cyanide 98-99 per cent. pure.

1½ ozs. (liquid measure) Sulphuric Acid best grade commercial (sp. gr. 1.83).

1½ ozs. (liquid measure) water.

The enclosed space should be computed, and the chemicals meted out accordingly. A stoneware jar of suitable size may be used as a generator. The water should always first be put in this and the acid poured in slowly in a thin stream with constant stirring. After filling the house or box with trees, place the jar inside and within easy reach of the door or lid. The cyanide is dropped into the jar and the operator should leave *at once*, and close the house immediately from the outside. *To breathe the fumes may be immediately fatal.* After the trees have been fumigated for half an hour the box or house may be opened *from*

* Maryland Agr. Exp. Station Bulletin, 57, p. 93, 1898.

the outside, using the greatest care to withdraw at once to a safe distance. Ten minutes should elapse before anyone attempts to remove the trees. The trees, if dormant, will not be injured if left in the gas a much longer time or overnight. This treatment is said to kill every form of animal life, and the operators should use every precaution in handling the chemicals and generating the gas in order to prevent accidents.

Cyanide of potassium is a most deadly poison.

Kerosene and water.—Kerosene alone has been used as a spray on plants with varying results. It is liable to injure the plants and is not to be advised for that reason. But kerosene can be mixed with water under pressure, a special pump being required for the purpose. Such a pump made by the Deming Co., Salem, Ohio, was figured in Bulletin 126 of this Station, p. 7. A similar pump is also manufactured by the Goulds Mfg. Co. of Seneca Falls, N. Y. Two seasons' experience in fighting San José scale in New York,* shows that 1 part of kerosene to 4 parts water (a 20 per cent. mixture) will kill the scale and not injure the plants.

Whale-oil Soap.—If one does not care to fumigate or go to the expense of buying a special pump for kerosene and water, he can destroy nearly all the scales by dipping or spraying the dormant trees with the following solution :

Whale-oil soap	2 lbs.
Water	1 gallon.

If the trees are in foliage, one pound of soap in five gallons of water may be used, but this will probably kill only the very young scales.

SUMMARY.

1. Most of the inspection laws are specially aimed at the detection and destruction of the San José Scale.
2. Inspections are of great value, but certificates are not proof that no scale exists in the nursery.
3. Nurserymen should either destroy all left-over stock or treat it before setting out in nursery rows.
4. The orchardist should also apply some treatment to the trees before planting permanently in the orchard.
5. Fumigating with hydrocyanic acid gas is the surest and cheapest method of destroying the scale upon nursery stock, but great care must be taken in using the gas, as it is very poisonous.
6. Spraying with kerosene and water or with a solution of whale-oil soap, as described above, is also effectual.

* Cornell Univ. Agr. Exp. Station Bulletin, 155, 1898.

APPENDIX.

General Account of the San José Scale.

NOTE.—The following, from Bulletin 121, published in 1895, is here reproduced for the benefit of those who are unfamiliar with the habits and appearance of the insect.

Appearance of the Scale.—When the scales occur singly they are not easy to detect with the naked eye; but when, as is usually the case, they occur in groups, they are easily seen as a grayish and roughened or pimply coating upon the bark. This coating, when scraped off with the thumb-nail or with the blade of a knife, appears mingled with a yellowish liquid if the insects composing it are alive. In severe cases the bark is completely covered with this scaly coating, and upon removing the bark the delicate tissues beneath are seen to present a pinkish or purplish color. When a tree is but slightly affected, the scales are usually found singly or in small groups upon the twigs, often at the base of the leaves. The separate scales measure, when fully grown, about one-eighth of an inch in diameter, are almost circular, slightly convex with a minute blackish projection in the center, and are of a dirty brown or gray color. The scale may be easily lifted upon the point of a pen-knife, and the insect beneath it, if alive, is seen as a small bit of yellowish jelly. This scale differs in appearance from other scales commonly found upon fruit trees; it is rounder than the "oyster-shell bark louse," and is smaller and darker in color than the "scurfy bark louse." In fact it is the only scale among those commonly found on fruit trees in Connecticut, which is distinctly circular in outline.

Effect of the scale on the trees.—The pernicious effects of the San José scale are in a great measure due to its inconspicuous character, and to the fact that its effect upon the vitality of the tree is not at once apparent. During the first season of its attack, the tree may be apparently healthy, with full leafage and abundant fruit. As the scale spreads, however, the effect becomes more plainly visible, though it is such as might readily be attributed to the attacks of borers or to drought. Only the most careful observation will discover the true cause of disturbance. Generally by the second or third season only does the scale become so abundant as to be conspicuous, and by that time the whole tree is infested with the grayish coating of scales; in its weakened

condition it succumbs easily to an exceptionally severe winter, and though it may put forth leaves, they shortly wither, and before the cause of the trouble is actually known, the tree is practically dead. If taken in time, however, it is not difficult to check its ravages, and we would therefore urge all fruit-growers to inspect their trees with care, and to send us specimens of any insect found bearing resemblance to this scale.

The introduction of the San José scale into the Eastern States has been traced to the importation of Japanese plum trees into New Jersey from California.

Like other scale insects, the San José scale can spread only a short distance each year, unless its distribution is aided by the agency of wind, water, or animals.

The San José scale survives the winter in a half-grown state. It becomes fully developed and reproduces about the last of May or first of June. The newly-born or hatched individuals, unlike their female parent, have no scaly covering but crawl about like ordinary plant lice. They are very small at first. The period of activity lasts but a day or two, sometimes only a few hours, when the young insects settle upon the bark and become fixed.

The scaly covering then begins to form. The insect soon molts and the cast-off skin uniting with a waxy secretion forms the visible external scale.

The female insect cannot change her place after the scaly covering begins to form, but the male is able to emerge from his cover, and being winged can travel short distances.